DOCUMENT RESUME

ED 206 267 IR 009 446

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TITLE Satellite-based Distance Education: Canadian Experiences.
PUB DATE Mar 81
NOTE 19p.: Best copy available. Paper presented at the Annual Conference of the SIETAR (7th, Vancouver, British Columbia, March 11-15, 1981).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Broadcast Television: Communication Research: *Communications Satellites: *Educational Change: Foreign Countries: Higher Education: History: Student Attitudes: *Teacher Attitudes: Telecommunications
IDENTIFIERS *Canada: *Distance Education

ABSTRACT

This report traces the successful evolution of Canada's experiments in satellite-based distance education, which provided the framework for Canada's most recent investment in 19 new exploratory projects in satellite communications, as well as a commitment to the accessibility of satellite-delivered television for any Canadian who wants it. The early Canadian experiments in satellite-based education are described, including the first project begun at the University of Quebec in 1976, and later programs at the University of Carleton in Ottawa, the British Columbia Institute of Technology, and the University of Victoria. Also discussed is the growing understanding among Canadian educators of the nature of satellite-based distance education: i.e., how it works, the demands it makes upon designers and instructors and students, the problems it can create and resolve, and the challenge it presents to conventional educational practices. Recommendations based on the findings of the initial Canadian experiments are offered which pertain to the preparation of students prior to an interactive session, effective use of discussion techniques, consideration of the number of students assigned to a center, and some ideas on what to expect with regard to distance students' attitudes towards interaction. (MER)

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Satellite-based Distance Education: Canadian Experiences

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Satellite-based Distance Education.

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November 20th and 24th 1980 were two very important days in the rapid evolution of Canadian communications satellite technology. On the first of those two dates, Francis Fox, Canada's Minister of Communications approved nineteen exploratory projects in satellite communications. Four days later he announced changes to the Canadian Federal government's policies for licensing T.V.R.O. (television receive-only) earth terminals whereby satellite-delivered television became easily accessible for any Canadian who wanted it. Mr. Fox, in making the announcement linked it to the rapidly growing interest through the country in distance education.:

> "With satellites becoming an increasingly attractive and efficient way of delivering ETV programming, I am happy to be able to give educational authorities the option of either leasing or buying their own TVRO's."[1]

This announcement, signalling to all educators, the Canadian Federal Government's formal commitment to distance education, had come just four years after the first educational experiments with satellites had been initiated in 1976.

Those preceding four years had produced a considerable variety of experiments in satellite-based distance education across the country, via the Canadian government's communications satellite Hermes. This satellite had been designed to test two improvements over its predecessors: operation at the 14 12GH$_z$ frequency band to avoid interference from signals from earth, and the development of portable earth terminals. When "air time" on Hermes was offered

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[1]Government of Canada Department of Communications Communiqué, November 24, 1980.

to various government departments and institutions the wide variety of experiments in distance education began. From these, and others that followed, has emerged a growing understanding of the nature of satellite-based distance education: how it works; the demands it makes upon designers, instructors and students; the problems it creates, the problems it resolves; and above all else, the challenge it presents to conventional educational practices.

The University of Quebec experimented extensively with Hermes. Student teachers in two remote sites were observed and assisted by university staff; students discussed library reference materials at a distance, via Hermes, with librarians; segments of courses in public administration and labour history were given in a form that has become known as the "telelecture"; the standard one-way video, two-way audio system was used to enable researchers at four remote sites to study microbiological specimens in an electron microscope.[2]

In another experiment, graduate courses were exchanged between Carleton University, Ottawa, in central Canada and Stanford University in California. This four-month project was supplemented with a two-day colloquium about satellites between Stanford and another Quebec university, the University of Montreal. In eastern Canada courses in medical education were delivered via Hermes from Memorial University in Newfoundland to doctors and nurses in four remote parts of that large and sparsely-populated province.

In British Columbia a provincial government-coordinated programme of experiments, the satellite-tele-education project (S.T.E.P.) brought together most of that province's universities and colleges. The British Columbia Institute of Technology explored video-simulation in a forestry course. The University of Victoria experimented widely with various instructional techniques and methods of involving students in discussions and interaction, using subjects such as the division of property in a divorce, the development

[2] Daniel, Dr. John S. "Satellites in distance education: Canadian experiments on the Hermes satellite" Athabasca University, (Canada) 1979.

of self-help groups, national political issues, and the impact of divorce upon children.

In each of these experiments a multitude of things happened that were "new" or certainly different experiences from those normally encountered by educators. In some cases Hermes brought people together in a way that was every bit as emotionally moving as it was intellectually stimulating. In other cases students became bored, technical problems made effective interaction impossible, information seemed colourless and static. Whatever the end of any experiment might have been, each one - both the "successes" and the "failures" - contributed to the growing list of things that obviously had to be considered when distance education was attempted. Now when one considers that education was only one of the aspects of Canadian life with which the Federal Department of Communications was concerned, - that additionally, government departments, were using Hermes for in-service information exchange purposes, and that the Canadian Broadcasting Corporation was examining its capacity to bring information and entertainment to people living in remote parts of northern Canada, one may reasonably conclude that this single but powerful satellite significantly altered Canadians' perceptions of their country, their access to information, and their ability to share their cultures.

On the horizon at this time (1976-77) was another Canadian development in telecommunications that may well effect the evolution of the country's communication systems in the 1980's as much as satellites will. This other device is Telidon, a videotex system, the result of the marriage between computers and telecommunications. Telidon has three components: data banks connected to a central computer; a modified television set equipped with a Telidon terminal

and keypad; and a transmission link such as a telephone, cable, optical fibre or satellite. When fully operating in a home, office or institution, Telidon could connect its user with his bank, post office, library, or information service. It could bring electronically into the home, office or classroom any information held in any data bank: electronic messages, news, catalogues or courses, in literary, photographic, or animated graphic form.

The potential impact of a marriage between Telidon and Hermes was revealed in mid summer of 1979 when technicans at the Canadian Communications Research Centre transmitted a signal from the Telidon-dedicated computer to Hermes and back in half a second. This preliminary test preceded a four day demonstration of the Telidon-Hermes link in August 1979 to the Institute of Radio and Electronics Engineers in Sydney Australia, for which purpose, Hermes was moved from its usual position in stationary orbit above the equator on a longtitudinal line roughly south of Los Angeles, to a new location over the middle of the Pacific ocean.

Obviously the individualized access to information that a Telidon-satellite link makes possible is going to present a challenge to educators that goes far beyond that presented by the satellites themselves. It could remove them from an interactive role. It could redefine their role from that of "teacher" to that of "course designer," "programmer," or manager of student-selected information services. Whatever new forms such challenges may cause to develop, one thing seems fairly certain: the traditional, classical role of the instructor as sophist, controller, decider and purveyor of regulated amounts of information, will change radically.

By the end of 1977 Canadian educators were asking a lot of questions about the utilization of satellites in distance education:

Who should have a licence?

How will the use of earth stations (i.e. 1.2m. dishes) be regulated?

Who should pay for programming?

How may constructive interaction be facilitated?

How may classroom and textbook course materials be adapted for video use?

How will needs be assessed in rural areas?

How will academics and instructors be trained?

What does a distance education producer do?

How will academic standards (set on campus) be maintained?

What will the role of tutors be?

Is satellite-based distance education cost effective?

How will courses, programmes be evaluated?

Do these devices (Telidon, Hermes) signify the demise of the classical institution?

What are the differences between learning behaviours in a classroom and in a distance education experience?

Do those assumptions we make about the validity of our thinking and verbal communication processes in classroom-based instructional situations, hold true for satellite-based video instruction?

Anik-B became available for distance education use about two years ago. Located in stationary orbit 36,000 km above the earth's surface in approximately the same area as Hermes, this satellite provides channels in the same super

high frequency bands as did Hermes, i.e. 14 and 12 Gigahertz. Thus the exploration of the use of small, relatively inexpensive earth stations that had begun with Hermes, has continued with Anik-B.

Experiment with Anik-B has been extensive, and a listing of current projects illustrates the degree of intensity with which Canadians have explored this communication medium:

- Development of a video-conferencing network for the government of Ontario
- The establishment of The Knowledge Network of the West (K.N.O.W.) - an interactive educational television service for British Columbia
- Establishment of an interactive distance education system for Alberta
- The Northern Ontario Hybrid Direct Broadcast Operational Trial - - a t.v. broadcasting project to deliver educational programming to remote areas of Ontario
- Program Delivery Pilot Project (West) - a Canadian Broadcasting Corporation project to bring broadcast television to Northern British Columbia, the Yukon and the Northwest Territories
- Memorial University Project - a satellite-based telephone network linking Memorial University in Newfoundland with remote communities in Labrador for health and education exchanges
- Inukshuk - a video/audio system linking remote Inuit villages for educational and community purposes
- Long Baseline Interometer - a University of Toronto project linking radio telescopes for geophysical studies
- Naalakvik II - inter-community programming among Inuit settlements in northern Quebec

- Teleprinter and Telidon News-Information Signals - satellite delivery of news directly to radio and television stations
- Electronic News Gathering - tests of a portable earth station to provide C.B.C. on the spot news coverage
- Transportable telephony earth stations - trials of highly portable earth stations for industrial use
- Inter-Omnibus - satellite extension of Université du Quebec teleconferencing system to remote areas of the province
- DOMSAT - further support for Australia's development of a domestic satellite system
- Portée de Voix - educational exchanges between francophone groups in Canada

For distance educators, one of the most interesting places to be in 1981 is British Columbia in western Canada. That province's response to the availability of the Hermes and Anik-B satellites has over the past four years noticeably altered the lives of the two and a half million people who inhabit this mountainous part of North America, particularly the one million people who do not live in the city of Vancouver, and for whom the mountains have traditionally been a barrier to communication.

The British Columbia provincial government's response to the presence of the satellites has recently taken the form of a province-wide interactive satellite-based educational broadcasting system called The Knowledge Network of the West. It was developed as a coordinating and delivery system for the educational projects of the province's three universities and fourteen community colleges. It is in its first year of operation and is currently being used by the following institutions and organizations:

The University of Victoria
Simon Fraser University

The University of British Columbia
The British Columbia Institute of Technology
The Open Learning Institute of British Columbia
The Pacific Vocational College
North Island College
The Ministries of Education, Forests, Health, Labour, Transportation and Highways
The Royal Canadian Mounted Police
The British Columbia Recreation Association
The Continuing Legal Education Society of British Columbia
The Outdoor Recreation Council
The Society of Engineering Technologies of British Columbia

These institutions and organizations have three methods of using the Anik-B satellite:

a) via a video link connecting all major institutions

b) via purchase or production of telecourses

c) by producing interactive courses

Between them, they are offering the people of British Columbia the following courses during 1981:

Public Administration
Education Administration
Aircraft Maintenance
Legal Services
Special Education
Leisure Education
Calculus
Nursing Assessment
Crime
Psychology
Art
Rock Music
Physiology
Women's Issues

What has been learned about the use of satellites in distance education? What are the advantages? When is satellite use appropriate and when is it not? In what ways does it facilitate learning? In what ways does it hinder communication?

Currently Canadian educators feel that they are in a position to address such questions as these. At the University of Victoria in British Columbia educators experimenting with both the Hermes and Anik-B satellites have gathered a multitude of observations and questions about the nature of satellite-based distance education. They have learned, for example, that facilitating interaction is a skill, a craft that requires sensitivity to the students, understanding of the process of communication and a clear understanding of satellite technology. They have learned that the students need tutors and local managers of their learning; that academics intending to instruct via satellite require training in communication skills. They have learned that the design of a distance course is a unique process. In some instances a satellite-based course or programme may be far more carefully designed and presented than its on-campus equivalent. On other occasions it may appear to students to be so rigid that they feel constrained and manipulated instead of enlightened.

How does a course production team make interaction work?

"Interactive" may be an easily-used catchword, but interaction in distance education does not simply happen because of the presence of a satellite. The facilitation of interaction is a skill that distance educators need to learn. It appears to depend upon six components:

a) Preparation of students prior to the interactive session

Because of the special problems that occur in the communication process when a satellite-based system is placed between teacher and student, interaction frequently suffers from a lack of concensus among programme participants. Often there is confusion about the main points being made by the

instructor. Thus questions and comments - which must be posed efficiently because of time constraints - can become vague or repetitive. This problem, which is one of entropy, can be avoided by sending students, in the mail, a summary of the points the instructor intends to make and the issues he intends to raise. Thus alerted, the students find the presentation easier to follow, are able to identify issues of particular concern to themselves prior to the telecast, and will approach the period of the telecast that has been set aside for interaction with greater confidence, and perhaps, some degree of preparedness.

b) Effective use of discussion techniques

Satellite-based courses and programmes frequently comprise an introductory lecture or demonstration followed by an interactive period of questions and discussion. In the University of Victoria Hermes experiments, the production team learned early on that not only were questions frequently repeated as the instructor contacted each centre, but often they were repeated by several students within the same centre. It was concluded that students might benefit from having a discussion period prior to interaction with the instructor. During this time in each centre, they could discuss issues raised and formulate one or two questions that represented the concerns and interests of their entire group.

To facilitate this, the University's instructors would go "off the air" for approximately fifteen minutes prior to the interaction period so that the programme participants (students) in each centre could engage in a previously-planned, controlled discussion of the issues raised (and where possible mailed prior to the session). Several discussion techniques were explored. The one preferred is sometimes referred to as the 2-6-12 technique. It works in the following way:

First, the participants arrange themselves in pairs. For about five minutes each pair discusses the presentation and formulates questions and discussion points.

Secondly, three pairs join together to form a group of six. Within this group each pair describes to the other two the questions and concerns they have. The three pairs then priorize all their questions and concerns, grouping them where possible. From this they formulate just one or two points that are of most importance to them as a group.

Finally, two groups of six join to make one group of twelve. A spokesperson from each of the two groups describes the points previously determined, and the twelve now set about the task of formulating one or two questions or concerns that are phrased in such a way as to incorporate as many as possible, of the points made when the participants were in smaller groups.

When the time comes for the participants to interact with the instructor, the questions and points voiced by one member of the group will represent the concerns of most members.

Obviously, the process is not rigid. 2-4-8, or 3-9-18 combinations will work equally well. Supplementary questions may be asked, and, where time permits, individuals may be able to pose additional questions. Whatever modifications are employed, this particular technique does at least ensure that many participants become involved in the interactional process. All are interested in the response and debate that follows because all were involved in the formulation of the questions.

c) Consideration of the number of students in a centre

For many reasons - some of which are budgetary - course designers like

to gather large numbers of students into receiving centres. In the experience of University of Victoria educators this can constrain interaction. Obviously the attraction of a satellite is its "mass" communication capability. However, large groups at any one centre make effective interaction difficult. It appears that:

(i) Where large groups are unavoidable, interaction should be confined to members of the group after the programme has concluded. In such a case there would be no attempt to provide interaction between the participants and the instructors.

(ii) If interaction is required in programmes delivered to heavily populated receiving centres, preparatory discussionsutilizing some method such as 2-6-12 are essential. In such cases a local coordinator or mentor is very desirable.

d) Distance students' attitudes towards interaction

Consider the differences of motivation and purpose that exist between an instructor and a student in a satellite-based interactive system. One has been deeply involved in a planning, design and production process, has been paid for his involvement, and knows that at broadcast time he is the focal point of the programme. The other has had no such involvement, in fact he may be very ignorant of the subject. He may well have done a full day's work prior to attending the interactive session. Or, he may be under-employed or unemployed and hanging his hopes for his future on the course. Thus when he arrives at the centre he may be timid, apprehensive, shy, skeptical, enthusiastic, hopeful: any one, or all of these. The demand that he participate may not evoke in him the spontaneous enthusiasm the instructor assumes.

Members of the University of Victoria's distance education course design groups have enccuntered an extensive variety of "students" and student behaviours: the silent groups from whom nothing can be dragged; the tea and coffee drinkers who interpret interaction time as a break; the enthusiastic but shy or inarticulate individual who finds it difficult to talk publicly over such distance; the curious learner - and there are many of these - un-used to the disembodied seminar, who needs a lot more time than can be given; the "religious nut" for whom Jesus is the answer to every question the instructor has raised, and for whom the satellite provides a unique, opportunity to preach to a global congregation.

There appear to be many types of distance-education students. Most seem to fall into the following categories:

Some are shy.

Others are intimidated by an enthusiastic authority.

Some require time to think about the information they have been given, to digest it.

Some find it difficult to express themselves, and, lacking a visual contact with their instructor, prefer not to discuss.

Some feel constrained by the artificial limits placed upon learning by the structure of the satellite-based experience: the instructor's request for "one question only per centre" irritates them.

Some academics and instructors find it difficult to respond briefly, and as the minimal amount of prescribed time passes rapidly by, students who realize that their question will not be adequately addressed, become impatient or withdrawn.

Many students respond with interest and enthusiasm.

The important thing to note here is that a distance education class may contain all or any of the types listed.

Interactive satellite-based instruction is largely dependent upon careful planning and course design, - a process which draws heavily upon the principles of educational technology. Just as there appear to be several dominant issues concerning the interaction process, so certain characteristics of course design have become significant. The two that need to be discussed relate to the division of course material into modules and units, and the relationship between instructor and student. The demands and constraints imposed by the unique instructional system oblige course designers and instructors to pay meticulous attention to the principles of systematic design, and to the impact of a medium upon information. The question of how course material will be divided to fit the delivery mode becomes critical - far more so than occurs in traditional classroom-based situations. The divisional mode employed at the University of Victoria uses modules and units. A course may, for example, comprise six modules (i.e. segments) each of which may be divided into several units. One unit equates to one satellite session.

This mode has several things to recommend it:

(i) Modules are manageable segments - "mini-courses" in themselves.

(ii) Modules are transferable - the sequence of their delivery can be "shuffled" - altered to suit a specific situation.

(iii) Information changes rapidly and the life-span of a course is now only two or three years. It is easier to re-design specific modules than it is to re-design a complete course.

(iv) Modules may be taught by different instructors - i.e. a team-approach becomes possible.

The relationship between the instructor and each individual student is also very significant in satellite-based distance education. The student's assignment takes on a special meaning in the process: it is often the only link between student and instructor; it may be the only statement the student makes to the instructor. Learning and teaching are subjective processes. It is far simpler for an instructor to judge the worth of an assignment when he has seen, heard, sat with and been aware of the person who wrote it. It is far more difficult to make those necessarily subjective judgments without those incidental experiences. Thus the assignment becomes very important. The student, sensing this, often puts a special degree of care and thought into the assignment. Course designers in distance education have to concern themselves not only with what will be delivered to the student, but with what the student will deliver back.

Satellite-based distance education is no panacea. It may resolve some instructional problems. It certainly creates new ones.

It can be extremely impersonal. It is not possible to separate an instructor from the information he is delivering. They are one and the same thing. In a classroom the instructor's "treatment" of the information - the intermingling of that which makes him who he is and that which focuses on the subject with which he identifies himself, can produce the spark in the heart and mind of the student, that we often refer to as "comprehension," "recognition," or "understanding." The presence of a device - radio or television, satellite or cable relay station - between the instructor and the student, can block those essentially dynamic lines of communication and separate the two people in a way that dulls the interaction. In this sense

satellite-based, so-called "interactive" education can be very static rather than dynamic.

The demands upon a distance-education course designer are such that organization is tight, and, while this usually produces a very smooth, instructional sequence, it does create a serious problem. At issue is that perennial question "How do we learn?" The debate here may be between two extremes: (a) We learn by being taken deliberately and carefully, by a sensitive and experienced guide, along an established path. - or, (b) We learn through personal exploration. Each one of us comesto learning with a personal history - a unique programme in his head which must go where it will.

Whatever one's own view of learning may be, it is perhaps sufficient here to point out that satellite-based instruction does not lend itself to the latter of these two possibilities.

It can be a rigid process with little room for branching, for deviation from a set path. It is therefore, not a suitable instructional mode for everyone. Telidon may alter this and ultimately offer students a great deal of personal choice.

After several years of exploration of satellite-based instruction, distance educators at the University of Victoria and elsewhere in Canada are generally optimistic about the utilization of satellites for instruction. We are not, however, unaware of the problems their use creates. Nor are we unaware of the limits of our own use of them. Six "issues" may currently be identified, presented here for discussion, debate and resolution:

1. The communication process is a complicated one, much influenced by Murphy's law (entropy). Wedging a satellite system between two people who are trying to communicate may compound the possibilities for misinterpretation.

2. In a class situation a teacher frequently judges the effectiveness of his presentation from the non-verbal cues of the students. With a satellite, where interaction is being assumed, this is far more difficult.

3. How can we evaluate the learning that occurs in a satellite-based instructional situation?

4. We may need criteria for the selection of satellite-based course instructors; they may require special training.

5. Time-consuming and pioneering though it may be, the design, development and delivery of satellite-based courses is still perceived by many institutions as "teaching." Where publications and research rate high, it rates comparatively low. This prevents some academics from getting involved and thus slows development.

6. Throughout history, most communication devices, however "mass" and "national" they were to be, have become communication channels between elite groups. There are, in the world numerous "needs" which perhaps, should be addressed and met before this expensive device is used for something with as narrow in appeal as University courses. The real future for the communication satellite may be its capacity to provide basic information about literacy, health care, agriculture and population control to many people rather than its elite use by small groups.